RSOI: FORCE DEPLOYMENT BOTTLENECK

A Monograph
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ABSTRACT

RSOI: FORCE DEPLOYMENT BOTTLENECK

MAJ Mark A. D'Amato, USA, 43 pages

This study uses The Theory Of Constraints (TOC) management methodology and recent military missions to show that RSOI operations are generally the limiting constraint to force deployment operations. This runs counter to the popular belief that strategic lift is the limiting constraint.

The study begins by highlighting the genesis of the military's current force projection strategy and the resulting importance of rapid force deployments. This is followed by a discussion on the force deployment pipeline and on Reception, Staging, Onward Movement, and Integration (RSOI) operations.

The focus of Chapter 2 is explaining the TOC methodology and its application to force deployments. This chapter gives a detailed analysis of the five step process and uses military examples to help the reader understand its use as an analytical tool for planners and operators.

The bulk of the analysis is conducted in Chapter 3. Using TOC methodology, the Joint Flow and Analysis System for Transportation (JFAST) simulation, and some historical examples the study demonstrates that RSOI operations generally constrain force deployments. The chapter also discusses initiatives to break the constraint and improve flow through the system.

The study concludes with the following findings: (1) RSOI operations are the critical vulnerability to force deployment operations, (2) efforts to reduce flow should generally take priority over efforts to increase capacity at the constraint, (3) more strategic lift is not the answer, (4) improved planning and tracking tools are required, (4) a permanent and tailorable RSOI organization is needed to achieve unity of command and unity of effort, and (5) institutionalizing the process of continual improvement is required.

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CHAPTER 1

INTRODUCTION/BACKGROUND

BACKGROUND

A New National and Military Strategy

The victory of the United States and its allies over the Soviet Union and communism dictated a fundamental change in national security policy and strategy. With the defeat of communism in the Soviet Union, the nation no longer had an "evil empire" to focus its policies and role in international relations. As a result, the national strategy evolved from one focused on preventing the spread of communism to one of peaceful engagement in the world. This new world view has expanded the role of the military and has caused a fundamental change in its strategy. With no credible threat in Europe, the Army reduced its presence overseas and drew down its forces at home to provide the necessary peace dividend. All these factors dictated a change to the National Military Strategy. For the Army this meant less dependence on forward deployed forces and more reliance on power projection. This change in strategy has had far reaching consequences. Dependent on others to get it to the fight, the Army has had to focused much of its attention in areas it could, in the past, afford to ignore such as rapid mobilization and deployment, RSOI operations, and redeployment. Another example of this shift in focus is the Army's support for the procurement of new strategic lift assets such as the fast sealift ships and the C17 aircraft.

The military's first real test of its new force projection strategy occurred during Desert Shield/Desert Storm. This experience drove home the need for the Army to focus its efforts on force deployments. Desert Shield/Desert Storm, although successful, highlighted serious deficiencies in the military's ability to rapidly deploy forces to a theater of operations. It took nearly six months to deploy a credible offensive force with sustainment logistics. After the war, this was deemed unacceptable for future operations and much was done to correct the preconceived strategic lift shortfalls. Somalia and most recently Bosnia have continued to highlight the difficulties inherent in force deployment operations.

This force projection strategy is not likely to change in the near term. The Chairman of the Joint Chiefs of Staff in his Joint Vision 2010 reaffirmed the validity of a CONUS based force that must be able to respond quickly to various types of contingencies in the world. This thinking is reinforced by the number and type of recent contingencies the military has participated in. Appendix A, Figure 1-1 is a list of recent operations requiring the military to execute its power projection strategy.[1]

Future Warfare

The nature of future warfare has also had its impact on the Army's strategy, operations, and tactics. The expected increased lethality of modern weapons and the proliferation of smart munitions will continue the trend of enlargement of the battlespace as combat and combat support forces disperse to survive on the modern battlefield. This

need to disperse is characterized by Dr. Schneider as the "empty battlefield". This phenomena is reflected in many of the Army's efforts to reduce its logistics and combat support footprint through enhanced communications, greater situational awareness, and doctrinal changes such as split-based operations and distribution-based logistics.[2]

The Role of Technology and Economic Reality

No less important in significance is the role technology and a shrinking Army budget play in the Army's new focus for the future. Since the early 80s the necessity to maintain technological superiority over potential adversaries is firmly rooted in the thinking of Army leadership. This recent cultural proclivity for technological superiority coupled with the reality of a shrinking budget has forced the Army to re-think its current way of doing business. More than any other area, logistics has felt the sting of this new economic reality upon its current and future organizations and operations.

SIGNIFICANCE

It is clear that to achieve its purpose the military must be able to project power in the right place at the right time with the right force. Joint Vision 2010 recognized this need to "project power with the most capable forces, at the decisive time and place" as well. No longer forward deployed in strength, the Army must be able to quickly deploy and build up combat power in a theater of operations that could be anywhere in the world. One can characterize the movement of personnel, equipment and sustainment supplies from origin to destination as a pipeline. The capacity of this pipeline is key to

the ability of the military to project itself wherever it is needed. The purpose of this study is to analyze this pipeline, identify the limiting constraint within it, and discuss efforts to mitigate it. To do this, the study will use a combination of historical examples, recent studies, and various simulation scenarios. The payoff for successfully achieving this objective is increased pipeline throughput enhancing the military's "ability to project power with the most capable forces, at the decisive time and place." (Joint Vision 2010)

FORCE DEPLOYMENT PIPELINE

The deployment pipeline consists of six segments: (1) the unit's home station; (2) movement to the Ports of Embarkation (POE); (3) POEs both sea and air; (4) movement to Ports of Debarkation (POD); (5) PODs both sea and air; and (6) movement from a unit's tactical assembly area (TAA) forward onto the battlefield. This section will briefly describe each of these segments.

Home Station

This segment includes all actions the unit must take to prepare itself to deploy. The POM process for soldiers, preparing equipment and supplies for shipment, and the loading of these materials are examples of actions required at home station necessary to prepare the force for deployment. This segment can also include any additional training the unit must undergo prior to deployment. Typically, units with the assistance of the installation's supporting agencies perform the majority of the tasks required during this segment. It is also common for another unit(s) on the installation to become the "push"

unit which in essence does what is required to "push" the deploying unit through this segment of the pipeline.

Movement to POEs

The primary action during this segment is the moving of personnel, equipment, and supplies to the Ports of Embarkation. It includes all movement modes: road, rail, and air. Typically, heavy/oversized equipment is moved by rail or road. Personnel are moved by air or commercial ground transportation.

Ports of Embarkation

This segment includes all actions taken at the sea and air Ports of Embarkation (SPOE and APOE). Reception of personnel and supplies, loading of equipment on ships and planes, and necessary life support are all critical actions occurring at the POEs. Key to this segment as well are all the critical tasks performed at the port. Much of the specialized material handling equipment for bulk loading operations is operated by port personnel. Tug boat operations are crucial as well and are typically contracted by port authorities to perform their important function of leading ships in and out of harbor.

Movement to PODs

This is the segment where personnel, equipment and sustainment supplies are moved by strategic lift assets to the sea and air Ports of Debarkation (SPOD and APOD). Of all the segments, this one has received the majority of attention since the Gulf War.

The acquisition of the C17 aircraft, the Fast Sealift Ships (FSS) and the Long Range Medium Speed RO/RO (LMSR) ships has done much to break the preconceived strategic lift constraint. This is also the segment where Pre-positioning Afloat enters the pipeline.

PODs

This segment includes all actions taken at the SPOD(s) and APOD(s). This is also the segment where the Reception, Staging, Onward Movement and Integration (RSOI) process occurs. RSOI will be discussed in the next section.

Movement Forward From TAA To Final Destination On The Battlefield

This final segment of the force deployment pipeline comprises all the actions a unit takes to move forward to its battle position. Typically the unit will move using its organic equipment and supplementary common user land transportation (CULT) assets. In the case of light units, CULT transportation assets will be used to move them and their sustainment supplies forward. In the event of a long move for mechanized units, Heavy Equipment Transporter (HET) trucks will carry the tracked vehicles to a forward assembly area before they move into their final battle positions.

All of these together constitute a force's line of communication (LOC). The LOC is what connects the unit's home base to the contingency area of operation where it will operate. Flow of sustainment stocks, troops, equipment, and retrograde operations occur

over the LOC and are dependent on it. The LOC's length, composition, and capacity will vary depending on the type of operation and the location of the operation. Furthermore, not all assets enter the LOC at the same point of origin. Units may enter the LOC from Fort Bragg, North Carolina, while its sustainment supplies may enter it from New Cumberland Army Depot in Pennsylvania. Each portion of the LOC will also have different capacity levels. The capacity at Pope AFB in North Carolina is not the same as the capacity at Osan AFB in Korea. The port facility at Wilmington, North Carolina differs from that at Pusan Korea. The amount of strategic lift allocated for a Korean contingency will vary from that allocated to a Haitian contingency. Understanding the capacity of each segment of this pipeline is crucial for maximizing flow through it.

RECEPTION, STAGING, ONWARD MOVEMENT, AND INTEGRATED (RSOI)

Reception

RSOI operations begin at the Ports of Debarkation, for both sea and air movement. Normally, most soldiers enter the theater through the APOD(s) and most equipment is processed through the SPOD(s). Reception begins with the unloading of personnel and equipment from strategic lift. This part of the process includes all terminal operations. Terminal operations occur at both the ports and airfields. Joint Publication 1-02 defines terminal operations as: "The reception, processing, and staging of passengers; the receipt, transit, storage and marshaling of cargo; the loading and unloading of ships and aircraft; and the manifesting and forwarding of cargo and passengers to destination."[3] Marshaling equipment and personnel includes all actions

necessary to prepare each for onward movement. Another key activity that occurs during reception is the life support provided to personnel during this process. This support includes nearly all the CSS functions: supply (food, water, repair parts), medical, maintenance, and transportation. The reception process ends with the movement of equipment and personnel into staging areas.

Staging

The staging process begins once personnel and equipment arrive in their staging areas. It is at the staging areas where units are linked up with their equipment and the process of building combat power occurs. The definition of staging in Joint Pub 1-02 falls short of capturing the essence of this process. A recent study on the RSOI process conducted by the Institute for Defense Analysis first recognized this shortcoming and proposed a revised definition for staging. The study defined staging as follows:

> "The process of assembling, holding, and organizing arriving personnel and material into units and forces, and preparing them for onward movement and combat operations; providing life support for personnel until units become self-sustaining; and assembling, holding, and organizing arriving sustaining materiel for onward movement."[4]

Their revised definition adds the process of building combat power by assembling combat units and the sustainment material, equipment, and personnel necessary to provide support in theater.

To accomplish the operations inherent in the staging process there are a number of supporting nodes which are established and operated as the situation requires. The

Institute for Defense Analysis defined a supporting node as: "Designated locations along the lines of communication where functions supporting and facilitating deployment and sustainment of the force, or retrograde operations, are conducted."[5] To illustrate the potential complexity of RSOI operations, a short discussion of supporting nodes will suffice. "Supporting nodes are grouped by the type of activities they perform. They include: (1) Holding areas; (2) Unit RSOI Processing Areas; (3) Trans-shipment and intermodal transfer points; (3) Enroute support sites; and (4) Unit, force, and sustainment destinations.[6] These nodes are further broken down as follows:

Holding Areas:

-Personnel Holding Areas
- Aeromedical Evacuation Holding Area (AEHA)
- Air Terminal Personnel Holding Area (ATPHA)
- Driver Holding Area (DHA)
- Enemy Prisoner of War Holding Area (EPWHA)
- Non-combatant Evacuation Operation (NEO) Holding Area

-Materiel Holding Areas
- Cargo Holding/Handling Area (CaHA)
- Container Holding/Handling Area (CoHA)
- Frustrated Cargo Holding Area (FCHA)
- Prepositioned Equipment Site (PES)
- Prestock Supply Point (PSP)

Processing Areas:

- Vehicle Assembly Area (VAA)
- Convoy Assembly Area (CAA)
- Helicopter Assembly Area (HAA)
- Marshaling Area (MA)
- Helicopter Marshaling Area (HMA)

Trans-shipment and Intermodal Transfer Points:

- Air Freight Terminal

Air-to-Air Interface Site (AAIS)
Breakbulk Point (BBP)
First Destination Reporting Point (FDRP)
POL Transfer Point (PTP)
Railhead (RH)
Sea-to-Air Interface Site (SAIS)
Trailer Transfer Point (TTP)
Transshipment Point (TSP)

Enroute Support Sites:

Aircraft Enroute Support Sites (AESS)
Convoy Support Center (CSC)

Unit, Force, and Sustainment Destinations:

Final Destination (FD)
Tactical Assembly Area (TAA)
Supply Support Activity (SSA)
Non-Unit Related Personnel Activity (NRPA)[7]

The definitions and activities performed by each of these supporting nodes is not what's critical at this point in the discussion. What is important is an appreciation for the multitude of tasks and the complexity of operations that must be performed during RSOI operations. The staging process ends once units and sustainment stocks are prepared for onward movement.

Onward Movement

This portion of the RSOI process involves the moving of units and sustaining materiel from staging areas to tactical assembly areas (TAA) and distribution nodes. Movement control, common user line transportation (CULT) assets, Heavy Equipment Transporters (HET), and commercial and HNS transportation assets are extremely important during this phase of the process.

Integration

The integration process is where the transfer of authority for the unit or supplies occurs from the Theater Rear Commander (TRC) to its designated gaining command. This transfer of authority will typically occur at the TAA. The transfer of authority to the gaining unit at the TAA signals the end of the RSOI process.

RESEARCH QUESTION

What is the impact of Reception, Staging, Onward Movement, and Integration (RSOI) operations on force deployments and are they the primary constraint to the flow of forces into theater?

AREAS FOR FURTHER ANALYSIS AND LIMITATIONS OF THIS STUDY

This study does not attempt to apply Theory of Constraint (TOC)[8] methodology to prioritize improvements to RSOI operations. Using the TOC methodology to identify, exploit, and focus improvements on RSOI operations is applicable and worthy of further study. It is the next logical step to this study.

CHAPTER 2

THEORY OF CONSTRAINTS (TOC) AND ITS APPLICATION

WHAT IS TOC?

The Theory of Constraints is a management methodology that "is a specific application and extension of Pareto's law, which states that a few items will have a disproportionately larger impact on a system than the remaining majority of items."[9] Eliyahu M. Goldratt first introduced this methodology as a means of managing and synchronizing repetitive manufacturing operations. TOC provides the manager the ability to identify a system's limiting constraint and then focus efforts to mitigate that constraint in order to improve system output. Since the mid 1980s numerous Fortune 500 corporations to include GM, Westinghouse, Ford, RCA, General Electric, and Mars/M&M have used TOC to improve the efficiency of their manufacturing operations.[10] TOC is an extension TQM. Its use allows for the process on ongoing improvement inherent in TQM. It is an iterative process the manager can use to continually improve the operation under his control.

Initially conceived as a means to improve manufacturing operations, its methodology is applicable to numerous non-manufacturing operations. The key characteristics of a manufacturing process are: (1) a number of distinct and separate work stations, (2) where each work station performs a distinct and separate function, and (3) where the work-in-process (WIP) flows through each work station sequentially until the final product is produced and ultimately sold.[11] In this way, one can evaluate the

process at each work station and the flow between and through them. An automobile assembly line is a classic example of this process. More important to this study, the process of deploying military forces to a theater of operations and quickly building combat power meet the basic characteristics of the manufacturing process enumerated above. TOC methodology can therefore be used to analyze force deployment operations.

A principle assumption of TOC is that there is at least one bottleneck or constraint on each product or process, given that demand for it exceeds production capabilities. Constraints or bottlenecks are processes that limit throughput by limiting the flow through the system. In general terms, the workstations within the firm that have the least capacity relative to the demand placed on them are the constraints. Those stations with excess capacity are typically non-constraint resources. One way of looking at constraint and non-constraint resources is by using the analogy of water running through a funnel.[12] The wide mouth of the funnel is a non-constraint resource and the narrow spout is the bottleneck. Given that the amount of water flow exceeds the capacity of the spout, water begins to backup in the funnel. Water in the funnel is analogous to work-in-process (WIP).[13]

A key notion embedded in constant management is that the excess capacity of a non-constraining resource cannot be used to contribute to throughput. Furthermore, increasing the capacity at a non-constraint resource will have no impact on the system's production. Using the analogy of the funnel again; adding more water to the wide mouth

or making the mouth even wider will not increase the amount of water flowing through the spout. The funnel analogy can also be used to explain how WIP can lead to increased turn-around-time (TAT)/lead time through the system. The higher the water level in the funnel the longer it takes for all the water to exit the spout. Similarly, the more WIP within a particular process at a facility, the greater the length of time an individual component takes to complete the process.

TOC STEPS

TOC is a five step iterative process. The five steps are:

1. **IDENTIFY** the system constraint(s),
2. Decide how to **EXPLOIT** the constraint(s),
3. **SUBORDINATE** everything else to the above decision,
4. **ELEVATE** the system constraint(s), and
5. If in the previous steps, a constraint has been broken, go back to step 1.

Repeat the steps. **WARNING!!!!** Do not let **"inertia"** become the constraint.[14]

STEP 1: IDENTIFYING THE CONSTRAINT

Step 1 is the most important step in the iterative TOC process. From the research available it appears there are three basic methods for identifying the system constraint: (1) the data collection method; (2) the plant type method; and (3) the manual method.[15] Using these methods concurrently will yield the best results since each method can confirm or deny the results of the others.

The basic idea behind the data collection method is that the company's existing management information system should yield indicators which point to the limiting constraint in the system. In this method, total demand is calculated and compared to the capacity each resource has available for filling that demand. In the case of a military deployment, demand could be defined as the number and types of forces required in a theater by a certain time, i.e. two infantry divisions with sustaining logistics in theater by C+40. Current WIP (forces in the pipeline) must also be taken into account in determining resource capacity. This method, then, is highly dependent on data accuracy and ease of data manipulation.[16] The current information management systems in use may not yield these characteristics. The explosive development and use of simulations over the past ten years has made this method an attractive approach for many businesses. For the military, the JFAST simulation is a tool planners can use to analyze the flow for forces and equipment through the deployment pipeline.

The plant type method seeks to use three basic plant varieties to yield clues to the location of the constraint. These plant types are illustrated in Appendix A, Figure 2-1.[17] The deployment pipeline most closely approximates the A-Plant configuration. Equipment, personnel, and sustainment supplies are positioned at multiple locations and moved through multiple ports of embarkation (POE) to a theater which typically uses a smaller number of PODs. The key to identifying constraint resources in the A-Plant configuration is to look at late or missing parts and follow the routing backwards until they converge at a common resource. Looking at it from the other direction, long

inventory queues are also indicative of a constraint resource. Machines that have multiple uses and therefore require multiple setups are also potential bottlenecks. A singular, highly skilled individual can also become a constrained resource. A good example of this type individual are sea port stevedores. Bottlenecks in the A-Plant configuration are also prevalent where multiple subassemblies are joined together to form the next higher assembly.[18] A force deployment example of multiple subassemblies combined to form the next higher assembly is the rebuilding of combat power at the theater LOC during the staging phase of RSOI.

The manual method is the least expensive and potentially fastest way to identify constraint resources since it involves those engaged in the process. It also encourages worker participation in the process. This method relies on the experience and expertise of the workers and managers on the shop floor. Constraint resources are identified through visual inspection of the plant to determine where the greatest levels of WIP are located. Managers and production controllers should have a fairly good idea where more capacity is needed. Areas to look at include:

- specialized machines requiring lengthy setup
- resources requiring a frequent overtime
- highly skilled personnel
- machines requiring a great deal of maintenance
- machines or processes that run jobs in batches[19]

STEP 2: DECIDE HOW TO EXPLOIT/UTILIZE THE SYSTEM'S CONSTRAINT(S)

The basic idea underlying attempts to maximize throughput is to increase capacity at the constraint by either making better use of existing resources or by acquiring

additional capacity through capital investment. Exploiting the constraint is not the same as maximizing the utilization of that resource.[20] The constraint resource must be exploited according to the organization's goals. Moving un-needed supplies or moving the wrong troop mix through the constraint resource is not exploiting that resource. Goldratt further asks, "Do all the parts presently being processed by the bottleneck need to be processed by the bottleneck?" If not, divert them to nonconstraint resources. Split-based operations enabled by enhanced communications and automated control systems and the use of an Intermediate Staging Base (ISB) may be ways to shift parts to non-constraint resources.

A further implication of constraint exploitation is the need to schedule the constraint. Since a constraint resource controls the throughput of the facility, it needs to be the focal point of scheduling efforts. All scheduling or exploitation of the bottleneck will, in turn, dictate the rate at which other resources operate including material release into the plant, nonconstraint workcenters, final assembly, and shipment. The constraint dictates the flow of product through the plant and whoever performs scheduling must not accept any more requirements beyond those which can be processed through the bottleneck during a particular time period.[21] Conversely, the scheduler must decrease the risk of disruptions upstream of the constraint resource that might ultimately leave it idle. A time buffer (safety stock) at certain nonconstraint resources is a means to ensure maximum exploitation at the bottleneck by minimizing potential upstream disruptions.[22] A time buffer is a means to manage the statistical variation of processes at nonconstraint

resources. Variations might result from machine breakdowns, absenteeism, setup time fluctuations, unreliable vendors, or scrap. For force deployment operations the implications are very clear, scheduling pipeline flow is critical. Staging troops and equipment at nonconstraint resources like Ports of Embarkation (POE) become essential to ensure bottleneck exploitation. Likewise scheduling the flow of forces, equipment and supplies will be dictated by the capacity of the bottleneck in order to avoid potentially longer flow times. Tools to assist the planner's ability to determining the flow and safety stock requirements are key to maximizing throughput.

STEP 3: SUBORDINATE EVERYTHING ELSE TO THE ABOVE DECISION

The purpose of this step is to guarantee continued constraint exploitation by ensuring nonconstraints do not supply any more WIP inventory than can be processed effectively at the bottleneck.[23] This is an essential step to ensure that all efforts made to improve system throughput, actually accomplish that purpose. For example, if the limiting constraint for a potential force deployment is the POD, throwing more strategic lift at the problem will not increase system throughput since the POD will dictate the rate of system flow. Another key point to understand is that a fully operating constraint resource does not necessarily ensure exploitation of the constraint. Processing products through the constraint resource that cannot be sold because there is no market for it, is not exploiting the constraint. For force deployment, processing 'wrong' mix of forces through the POD is not exploiting the system constraint. Processing the 'right' mix of forces through the constraint resource then is key to exploiting the constraint.

STEP 4: ELEVATE THE SYSTEM'S CONSTRAINT(S)

The purpose of this step is to break the constraint and set the conditions for future operations. Once the system constraint is broken, what will then limit the system will be the previous second most constrained resource. Elevating the constraint may involve capital investment, policy changes, or even a new marketing approach to increase product demand. These options are expensive and may include long lead-times for implementation. It is also during this step when an organization can choose its system constraint as it plans for future capital investments and policy changes. Organizations do not possess unlimited resources. As a result, there will always be a system constraint. F. C. Weston sees this step as synonymous with strategic planning where an organization positions itself for future operations.[24] This is the point in the analysis where organizations review their plans for elevating future constraints by looking beyond the first level cause and effect of investment decisions.[25] The decision to buy more strategic air and sea lift would be an example of actions taken during this part of the analysis. Another would be a decision to upgrade infrastructure on posts responsible for mobilizing and processing deploying forces.

STEP 5: IF IN THE PREVIOUS STEPS A CONSTRAINT HAS BEEN BROKEN, GO BACK TO STEP 1. WARNING!!! DO NOT LET INERTIA BECOME THE CONSTRAINT

The successful eradication of a constraint is the birth of another. Continued improvement is the essence of this step. Removal of the system constraint will signal the beginning of this five step process to break the next one. In today's environment

organizations cannot afford to rest on their past accomplishments. An organization must embed in its culture an attitude and mindset of "continual improvement". Only in this way can an organization stay ahead of its competitors and ensure its long term viability. The results of a study which tracked the progress of 100 new companies showed that after ten years less than 10% were still in business![26] Edmund Burke, British author and statesman, wrote in 1790 in his Reflections on the Revolution in France, "A state without the means of change is without the means of its conservation." Although the Army probably does not have to fear for its existence, it does need to be concerned about its relevance. As the world changes, so must the Army lest it become obsolete.

TOC'S APPLICATION TO FORCE DEPLOYMENT OPERATIONS

Force deployment operations fit nicely into the TOC framework. As discussed earlier in this chapter it most closely resembles the A-Plant manufacturing configuration. Typically when forces deploy in response to a contingency somewhere, they will deploy from multiple locations through multiple POEs, they will move via strategic lift to the contingency area of operation, process through the PODs, and move to their final tactical area of operations via ground, rail, or tactical airlift. Each one of these steps is sequenced and must be performed before moving to the next step.[27] For example, during Desert Shield/Desert Storm, forces deployed from multiple bases both within and outside the United States. Multiple POEs were used to facilitate the movement from the various bases from which forces deployed. SPOEs on both the east and west coast of the United States were used extensively as well as numerous airfields within the United States. The

pipeline began to narrow as these forces, equipment, and sustainment stocks moved via strategic lift from the POEs to the PODs. The pipeline further narrowed as the troops and equipment arrived in country given the few airfields and seaports used within Saudi Arabia. As units cleared the rear areas and moved forward to their tactical area of operations, the pipeline began to open up again. The force deployment pipeline in this example tends to resemble a funnel where the wide part most closely represents the early stages of the flow and the narrow neck of the funnel represents the few PODs which they flowed through. This sequential flow through the force deployment pipeline facilitates analysis of each of its segments.

CHAPTER 3

THE SYSTEM CONSTRAINT AND ATTEMPTS TO BREAK IT

STEP 1 OF THE TOC PROCESS: IDENTIFYING THE CONSTRAINT

Manual Method

As explained in Chapter 2, the manual method is potentially the fastest means of identifying the system constraint. On the production line the manager can, with relative ease, follow the flow and identify where the largest amount of WIP is backing up. In the case of force deployment operations, one does not usually have this luxury. What is available are historical examples that will substitute for the shop floor. As noted in Chapter 1, there are many recent examples of force deployments throughout the world to deal with a variety of situations. Looking at a few of these historical examples will substitute for the assembly line and will yield the same result.

Desert Shield/Desert Storm

Desert Storm is the military's most recent large scale force deployment operation. This operation can provide valuable clues for identifying the system constraint in the force deployment pipeline. Project Air Force, a RAND study, provides some of the clues for the strategic airlift portion of the deployment. These clues include: (1) insufficient parking space at the APOD, (2) not enough offload points at the APOD to accommodate the airflow, (3) the threat of scud attacks which prevented the landing of CRAF aircraft, (4) reports of saturated airfields, (5) MHE shortages, (6) lack of refueling facilities, and (7) the opening of additional airfields to handle the airflow.[28] In addition to these clues

the report also clearly demonstrates that availability of strategic airlift did not limit the flow of forces into theater. In spite of lower than anticipated utilization rates for aircraft, strategic airlift moved 10% more dry cargo and 20% more sustainment cargo than initially envisioned by planners![29] This clearly demonstrates that excess capacity existed within this portion of the pipeline.

What then, limited the flow through the pipeline? Significant delays existed at both the APOEs and the APODs. Which was the more limiting? Looking at the records for ODS the verdict is still uncertain. Most of the reasons listed above apply to both APOEs and APODs. For example, the DRB of the 82d Airborne Division could not load available airlift fast enough causing delays at Pope AFB.[30] Appendix A, figure 3-1 graphically displays delays experienced at both APOEs and APODs.[31] From these two examples, it appears that the biggest delays were experienced at the APOEs. But these statistics do not tell the whole story. What is not quantified is the time troops, equipment, and supplies remained at the APOD undergoing RSOI operations! The reason for this discrepancy is simple. The military had no way to track and measure it. This is unfortunate and potentially damaging as institutional memory fades and the problem remains unanswered. But assembly areas packed with supplies and equipment, and personnel held up in temporary holding areas waiting to be linked with equipment and moved forward suggest that a significant amount of time was spent undergoing RSOI operations. That sustainment cargo was backlogged at Dhahran is unquestionable and at times exceeded 1,000 pallets.[32] This is significant because the goal is to get the "right"

mix of forces to the "right" place on the battlefield, and the APOD is not the "right" place. This RSOI "down time" coupled with delays at the APOD constituted the real WIP there. We cannot know for sure which constrained the flow more, but we can conclude that strategic airlift was not the limiting constraint. Fortunately other historical examples will provide a clearer picture of the limiting constraint.

The case of strategic sealift for ODS is more clear. The sealift supporting this regional contingency was among the largest in history moving 504,000 passengers, 3.6 million tons of dry cargo, and 6.1 million tons of petroleum products.[33] The primary SPOD for this contingency was Ad Damman followed by Al Jubayl with 60 and 20 piers respectively. According to USTRANSCOM the apex of the sealift was 31 December 1990 with 132 ships enroute, 57 ships returning, and 28 ships either loading or unloading for a total of 217 ships supporting the contingency.[34]

The first clue pointing toward the PODs as the system constraint was the "queue" of ships in front of them. Even long delays at the POEs in Europe during Phase II failed to eliminate the queue at the PODs.[35] The second clue concerns strategic lift assets. At the height of the sealift operation, not all available strategic lift was utilized. The Sealift Readiness Program (SRP), which would provide more ships if required, was never implemented because it just wasn't needed.[36]

Operation Restore Hope (Somalia)

Operation Restore Hope clearly show the PODs and RSOI operations as the limiting constraint in the force deployment pipeline for that operation. The reason is fairly obvious. Somalia is a third world nation lacking modern infrastructure. What infrastructure that did exist in the city of Mogadishu had been damaged as a result of an ongoing civil war between the various warring factions. Both the lack of modern infrastructure and the damage to it, significantly affected U. S. military force deployment operations. Additionally, relief agencies and other participating nations competing for the use of these constrained resources further exacerbated the problems faced by the United States. Fortunately for the United Nations the requirement for military forces was relatively small and the flow not overly time sensitive. The insufficiency of the SPOD made itself felt especially in relation to the use of FSS ships. There was only one berth available that could handle the FSS ships making it necessary to bring them in one at a time.[37] The backlog of these ships in harbor had the unfortunate effect of increasing the lead time for this equipment as extra time was expended in the jockeying of these ships in harbor! Unfortunately, these ships carried equipment necessary for Army forces to do their mission. The lack of infrastructure, equipment, and personnel on the ground in Mogadishu also slowed the remainder of the RSOI operations.[38]

The same problem existed at the APOD. The capacity of the airfield ended up dictating the air flow into the country. "During January, Army strength in Somalia tripled to just over 10,000 troops, well below the 13,400 that planners had envisioned

early in December. Sustainment airlift channel flights did not begin until late December, and even then the rate of cargo delivery was slow."[39] The limiting constraint in this operation was clearly not strategic airlift.

Prepositioning of equipment/stocks on strategic lift experienced similar problems as well.

> Army prepositioning ship performance was unsatisfactory, tolerable only in the context of the Restore Hope mission. Needed Army supplies and equipment, under the best of conditions, might have been delivered in the first week were not offloaded until much later. The earliest deliveries came at D+34, the latest at D+68.[40]

When No PODs Exist

The possibility of not having an APOD or SPOD near a potential area of operations is very real. The use of PODs is dependent upon agreements with the governments who control them. These agreements can become very fragile when national self interests between the two parties conflict. Saudi Arabia's refusal to allow U.S. and British military forces to use their airfields for a possible air strike against Iraq demonstrates the fragile nature of previous agreements. Nations can at will modify or revoke them denying use of infrastructure necessary for mission accomplishment. In this case the POD becomes a political war stopper vice the limiting constraint! Militarily the only option is a forced entry with the initial goal of seizing and expanding a lodgment for further force build-up.

Simulations (The Data Collection Method)

The Joint Flow and Analysis System for Transportation (JFAST) simulation gives us another way to identify the system constraint. The JFAST simulation is a resident part of the Global Command and Control System (GCCS). This simulation performs a transportation feasibility test for various deployment scenarios. This capability of the JFAST simulation will allow an analysis of transportation feasibility almost anywhere in the world. The JFAST simulation models the deployment of units down to company and detachment level as well as theater level stockage objectives for sustainment supplies. The model also accounts for the types of missions units will perform, the expected duration of each mission, the effects of climate in the area of operations, and legal and operating constraints that may apply to the deploying force.

> "The primary output of JFAST is an estimate of when forces will arrive at the theater port complexes. This information is important to theater LOC planners because it indicates when and where the supported command must be ready to receive the strategic flows of personnel, equipment, and sustaining cargo. In addition to estimating theater closure dates (at reception complexes) for the deploying force modules, JFAST presents a wealth of graphic and tabular output showing the impact of a force deployment option upon strategic transportation resources and the reception terminals used during the simulation."[41]

The capability of JFAST to show the impact of force deployments on strategic lift and reception terminals (PODs) makes this simulation a valuable tool for identifying the system constraint in the force deployment pipeline. The primary shortcoming is that the analysis stops at the reception facilities. Ideally, an automated system would model the process from beginning to end since an impact anywhere in the system affects all other

inputs within the system. Such a capability currently does not exist. Most notably, there is no automated routine that allows analysis of the flow through the various nodes where RSOI operations occur. Planners must currently do this analysis manually! Yet, this shortcoming will not prohibit our ability to focus in on the limiting constraint in the pipeline. However, it will keep us from analyzing that constraint directly and limit our ability to measure accurately efforts to mitigate the constraint. At best, one can identify the constraint and then conclude that efforts to mitigate it will have the positive effect of increasing flow through the system. How much of an increase and prioritizing the improvements are at best an estimate. At the very least, the need for such an automated tool is substantiated.

A force deployment scenario to the Philippines was run in the JFAST simulation to show the impact this deployment operation would have on pipeline flow. Appendix B shows the forces, strategic lift, POEs, PODs, and various other settings used while running this simulation. In general, a light division with a heavy slice and supporting COSCOM elements were moved from home station into the area of operation. The first run was made using one APOD and one SPOD. An additional APOD and SPOD were added on the second run in order to analyze the impact of increasing reception capability.

The results of both runs show significant delays at the SPOD. With only one APOD, the flow of personnel was somewhat constrained. The addition of another APOD for the second run eliminated that constraint. What is most significant is that

strategic lift did not constrain the flow of forces, equipment, and sustainment supplies into theater. Significant delays occurred in the SPODs. One might assume it is a lack of berthing space and given the limitations of the simulation, a good case can probably be made for it.[42] But, it must be reiterated that the simulation does not allow a complete analysis beyond the reception node.[43] It does, however, clearly show that the system constraint is at the PODs where RSOI operations take place.

STEPS 2, 3, AND 4: EXPLOITING AND BREAKING THE CONSTRAINT

Increasing the Capacity of the Constraint

Increasing the capacity of the constraint is an obvious way to exploit it. One can increase its capacity either directly or indirectly. Adding more cranes, berths, or warehousing space at the port is a direct means of increasing its capacity. Improving port organization or command and control will do the same thing indirectly by allowing more efficient operations resulting in more flow through it. This section will focus on both direct and indirect means to exploit the system constraint.

Direct Means

Direct means of increasing capacity almost always translate into infrastructure improvement at those facilities. Building airfields and improving port facilities in probable areas of future force deployments is the most common direct means of increasing capacity at potential PODs. There are many examples of these types of infrastructure improvements ranging from the construction of airfields in numerous

Central and South American countries to economic aid provided to other countries with the stipulation that such aid be tied to the improvement of ports, airfields, rail, and road networks. Other infrastructure improvements include the construction of additional warehousing space, upgrade of material handling equipment supporting the PODs, and improvement of a country's telecommunications network. Another way the military can influence a host nation's infrastructure is through agreements authorizing the basing of military forces in that country. Once the military has a forward presence in a country it can negotiate for the construction and/or improvement of airfields, ports, and other infrastructure necessary to support it as well as for projected force deployments in the event of a contingency in that country or region.

Indirect Means

Capacity at the PODs can also be increased indirectly by increasing the efficiency of the resources used at the constraint. Unlike direct means, indirect means are theoretically easier to implement since they generally fall under the control of the military. These indirect means could entail changes to military organization, doctrine, command and control, and resource allocation. However, in practice, these changes may be equally hard to implement given that they may be seen as a potential "threat" to one of the services or to a branch within a service.[44]

RSOI Organization

The military currently does not have an organization that is specifically designed to conduct and command and control RSOI operations. The concept of the Theater Support Command (TSC) is designed to fix this shortcoming by providing "a flexible and adaptable command structure for echelons above corps (EAC) force projection and sustainment operations in a theater of operations."[45] It involves a change in organization, doctrine, command and control, and to a limited extent resource allocation. If it ever gets approved, this organization will replace the functionally organized Theater Army Area Command (TAACOM) concept and the Corps Support Group (CSG) typically used for OOTW contingencies not requiring the robust support and large footprint of a TAACOM. The TSC concept is designed to be subordinate to the Army Service Component Commander (ASCC) but will allow for augmentation from other services in the form of liaison sections in order to facilitate support for joint and combined RSOI and sustainment operations. Appendix A, figure 3-2 shows the planned relationship of the TSC to the services in theater.[46]

The TSC concept umbrellas the concepts of modularity, split-based operations, and battlefield distribution (BD).[47] It will also serve as the link between the operational and tactical levels of logistic sustainment to the strategic level by incorporating the US Army Materiel Command's (USAMC) Logistics Support Element (LSE) and the Logistics Civil Augmentation Program (LOGCAP) into its structure. The LSE controls all USAMC elements in theater and can provide extensive support to the theater

commander to include: "oil analysis, calibration, depot maintenance, ammunition surveillance, Army War Reserve Stock hand-off, LOGCAP oversight, technology insertion, and battle damage assessment."[48] The LOGCAP program deals primarily with contract support to CINC's in both peace time and during contingency operations. It contracts with commercial firms to prepare support plans for specific identified requirements in the event of a contingency.[49] Appendix A, figure 3-3 shows the proposed organization for this command.

In terms of force deployment operations, the TSC will indirectly increase the flow through the pipeline by improving the efficiency of the resources at the system constraint. It primarily achieves this objective through unity of command and unity of effort. By replacing traditionally separate functional organizations within the TAACOM into a multi-functional organization with a single commander, orchestration of RSOI operations and sustainment logistics is more assured.

Both direct and indirect means can be used to increase the capacity of the system constraint. Direct means generally entail the construction of additional infrastructure or improvements to existing facilities. The advantage of increasing the capacity of the constraint is that they exploit and eventually break the constraint. The biggest shortcoming of this method is the limited ability of the military to influence it, its cost, and the long lead time required for infrastructure improvements. On the other hand, indirect means to exploit the constraint have the advantage of generally being completely

under the purview of the military. The services can directly control their organization and doctrine, and can choose to devote sufficient resources to those initiatives which will yield positive results for force deployments.

Reducing the Flow Through the Constraint

Another way to exploit the constraint is to reduce the flow through the constraint. Reducing the flow sufficiently will break the constraint as demand for it is less than its capacity.

Several ongoing logistics initiatives will have a profound impact on force deployment operations. These initiatives will ultimately decrease the flow of materials through the pipeline. Total Asset Visibility (TAV), Velocity Management (VM), and Battlefield Distribution (BD) are each a part of the logistics community's attempt to change from a supply based logistics system to a distribution based system.[50] These initiatives attempt to correct the shortcomings experienced during the Gulf War as well as transform the current logistics system into one that can adequately support the military's force projection strategy. This is significant because these management philosophies while attempting to correct deficiencies in the logistics system in the field also have the positive effect of reducing the flow of materials and supplies through the force deployment pipeline.

Battlefield Distribution was an initiative introduced after the Gulf War by MG Robeson, Combined Arms Support Command (CASCOM) commander, that focused on improving the theater distribution system.[51] He envisioned a fully integrated distribution system that would provide the warfighting commanders maximum throughput and total visibility of supplies, personnel, and equipment. The original BD concept included the integration of traditionally separate functions into BD organizations. BD attempted to address the distribution and accountability problems experienced in the Gulf War, but the scare of fundamental changes to logistics organizations caused luke warm acceptance of its ideas by the power brokers in the logistics community.

The advent of the Force XXI initiative coupled with a shrinking budget has breathed new life into the BD concept.[52] Whereas the initial concept implied significant organizational changes, to make it more palatable, the new way of thinking about it envisions only limited organizational restructuring. Instead of re-engineering organizations, the concept sells the more acceptable and less revolutionary re-engineering of battlefield operating procedures, improved doctrine, and leveraging of technology.[53] Central to BD is the notion of a hub and spoke distribution system. This has critical implications for force projection operations since the hub will most likely be the APOD/SPOD, the system constraint.

In January 1995, a better received and complimentary solution, called Velocity Management (VM) was initiated. VM is a combination of BD, Total Quality Management (TQM), and The Theory of Constraints (TOC).[54] It is a management philosophy that stresses continual improvement, precision and speed over mass, and identification and elimination of inefficient processes in the logistics system.[55] "It applies a number of management methods used throughout industry to reduce large resource investments and reduce cycle times for all logistics processes."[56] The program has three major components: (1) reduction of order ship time (OST); (2) reduction of repair cycle time (RCT); and (3) increase and build confidence in the system thereby allowing the reduction and/or elimination of inventories at every level in the system. The goal of the program is a reliable, flexible, responsive, and customer-focused logistics system.[57]

VM has received significant support from the highest levels of Army leadership and has been very successful in reducing inventory and its associated costs. Appendix A, Figure 3-4 contains some extracted statistics from June - August 1997 that illustrate this point. In every case, organizations have significantly reduced lead-time for repair parts. This is important given that inventory level is directly proportionate to lead-time for parts. As

inventory requirements decrease, so does the amount of supplies that must be moved through the deployment pipeline and the system constraint.

TAV

Another recent logistics initiative that will reduce the flow through the pipeline is Total Asset Visibility (TAV). The idea behind the TAV concept is simple: provide leaders with asset visibility of equipment, supplies, and personnel throughout the entire system. This concept of total asset visibility will result in (1) enhanced user confidence minimizing the ordering of unneeded spares and equipment; (2) allow leaders to redirect the flow of equipment, inventory, and personnel within and between theaters; and (3) minimize variability in the flow through the system. TAV's positive influence on the flow of inventory, equipment, and personnel through the system is primarily moral. Increased confidence for those that use it as well as those that manage it will result in an overall reduction in the flow through the pipeline by minimizing the ordering and movement of safety stocks to deal with uncertainty in the current system.

The military's TAV concept was originally conceived by the Strategic Logistics Agency. But its utility was first recognized and used by commercial firms like UPS, Wal Mart, Federal Express and many other businesses where inventory is a key part of their business operations.[58] Improvements in

information technologies and automation made the concept possible. The military was just slow to recognize its benefits.[59] TAV consists of two parts: (1) Asset Visibility and (2) Intransit Visibility (ITV). Asset visibility applies to stored inventory and ITV covers the transportation part of that inventory through the system.[60]

The Global Transportation Network (GTN) being developed by USTRANSCOM is the automated system that will provide users and managers intransit visibility. The system is expected to be totally functional by 1999 and will provide intransit visibility during movement. It will also generate information on seaports, airfields and transportation networks, provide transportation planning and feasibility estimates, and monitor patient movement.

Split Based Operations

Split Based Operations are another way of reducing the flow through the pipeline. The idea inherent in this concept is to exploit the advantages of improved automated control systems which allow management and control functions to be performed separate from the physical location of the commodity and to deploy only those forces necessary to handle the commodity within the theater of operations.

Logistics Over The Shore (LOTS)

LOTS will also have the effect of reducing the flow of sustainment materials and supplies through the PODs. LOTS minimizes the need for a fix port facility and will allow the military to flow logistics from an established beachhead. The drawback with LOTS is that it comes with its own overhead and requires special ships and equipment capable of performing that mission. Regardless of this drawback, LOTS offers the commander a viable option for increasing throughput by bypassing the system constraint.

The Role of Host Nation Support and Contracting

The use of HNS and contracting can also reduce the flow through the pipeline by eliminating the need to deploy certain types of personnel and equipment. The military's reliance on HNS and contracting is growing, especially in OOTW type operations. Most recently, the Bosnian peace enforcement mission highlights the growing importance of both. For example, the American commercial firm Brown and Root was contracted to build and support the base camps used by US forces in country. Many of Brown and Root's workers were contracted from the local population to perform a variety of support missions from driving trucks to maintaining power generation equipment.

There are a couple of significant limitations concerning the use of HNS and contracting. First, as was seen during ODS, commercial concerns may be reluctant to operate in an area that is not secure.[61] Second, in less developed countries where future conflict is likely, specialized HNS may not be available. Somalia is a good example where the lack of infrastructure and skilled labor limited the amount of HNS available to the military.

CHAPTER 4

CONCLUSIONS

CRITICAL VULNERABILITY

The first conclusion one can draw from the study is that the system constraint is the de facto critical vulnerability in the force deployment pipeline. As such, it must be protected against disruptions of any kind. Disruptions at the system constraint will reduce the flow through the pipeline. This is a key point that commanders at all levels must thoroughly understand. Our inclination is typically to accept risk in the rear area. However, this is precisely where a force can least afford it, especially in the early stages of building up a theater. As the theater matures and sufficient combat power is deployed, RSOI operations will diminish in importance.

INCREASE CAPACITY OF CONSTRAINT OR REDUCE THE FLOW THROUGH IT?

Chapter 3 of this study looked at ways to increase capacity at the constraint and ways to reduce the flow through it. Which is more important? Obviously, if a choice has to be made between the two, the priority should generally go to those that reduce the flow through the constraint. As noted earlier, infrastructure improvements are difficult to influence, expensive and take a long time to build. They are also only useful in the theater inwhich they are located. Whereas initiatives that reduce the flow through the pipeline apply to all potential theaters and are applicable throughout the range of military contingencies. In general then, priority should be given to initiatives that reduce the flow through the pipeline. The one major exception to this rule is the need for an

organization that is specifically designed to conduct and C2 RSOI operations. This exception will be addressed later in the chapter.

STRATEGIC LIFT IS NOT THE ANSWER

TOC methodology demonstrates that increasing capacity at a non-constraint resource will have no impact on the system production capability. Since strategic lift is not the bottleneck in the pipeline, applying more of it to the problem will not increase system throughput. In fact, the opposite is likely to occur -- system throughput will decrease. As was seen in Somalia, the FSS ships, once the pipeline is full and flowing, may actually slow the flow of forces and sustainment stocks by congesting the ports.

How to best load strategic lift assets is also at issue. Typically, the transportation community will push for administrative loading of strategic lift assets because it is the most efficient way to load. This de facto approach is myopic. The problem with administrative loading is that a ship may contain equipment belonging to numerous units resulting in a more complicated RSOI process in theater. This difficulty in "marrying up" people and equipment was painfully demonstrated during Desert Shield/Desert Storm. Since strategic lift is generally not the pipeline constraint, unit loading of equipment may increase throughput by simplifying the RSOI process on the receiving end. It will likewise better serve the theater commander by more quickly getting combat capable units to their final destinations in theater.

IMPROVED PLANNING AND TRACKING TOOLS ARE REQUIRED

This study also shows that the system constraint will dictate the rate of flow through the system. Therefore planners must schedule the flow of forces based on the capacity of the constraint. Given this, planners and operators must possess the means to accurately identify the constraint and assess the impact of measures taken to exploit it. Currently, no simulation or model exists that gives the planner/operator the tools necessary to establish, modify, and monitor the flow through the system. Priority should be given to the development of an automated program to provide planners the ability to realistically plan and track the flow of forces through the pipeline.

THE NEED FOR A PERMANENT AND TAILORABLE RSOI ORGANIZATION

Given the multitude of tasks and complexity of RSOI and sustainment operations, a permanent and tailorable RSOI organization is required to ensure unity of command and unity of effort. Currently, the SPODs are managed by MTMC, the APODs are managed by MAC, and RSOI operations are managed by the TRC (usually an Army general under the preponderance of force concept) through the TAACOM or CSG in smaller deployments. Some of the functions of each will necessarily overlap. How does the combatant commander ensure these separate nodes and functions have the same focus and work toward a common objective? Currently, much is left to chance. Joint Pub 4.0 recommends a single command authority for logistics, but ultimately the same doctrine specifies that each service is responsible for it own internal sustainment support. In practice, the J4 convenes a series of Joint Boards in an effort to reduce duplication and

ensure unity of effort. Although this approach has worked in the past, it is dependent on cooperation, compromise, and large staffs. More importantly, the J4 is a staff officer not a commander and as such cannot direct operations. The TSC is a good way to ensure unity of command and unity of effort in the theater rear area. The Institute for Defense Analyses recommends a Joint Theater Support Commander and they make a good case for it.[62] The problem with their recommendation is the feasibility of its implementation. The Army has been trying for nearly three years to come to grips with the TSC. Imagine how long it would take for the Services to agree to a joint organization! The solution more likely to be implemented is the TSC. Once implemented, the TSC will indirectly increase the flow through the pipeline by improving the efficiency of the resources at the system constraint. It primarily achieves this objective through unity of command and unity of effort. Priority should be given to its development and implementation.

STEP 5 INSTITUTIONALIZING THE PROCESS OF CONTINUAL IMPROVEMENT

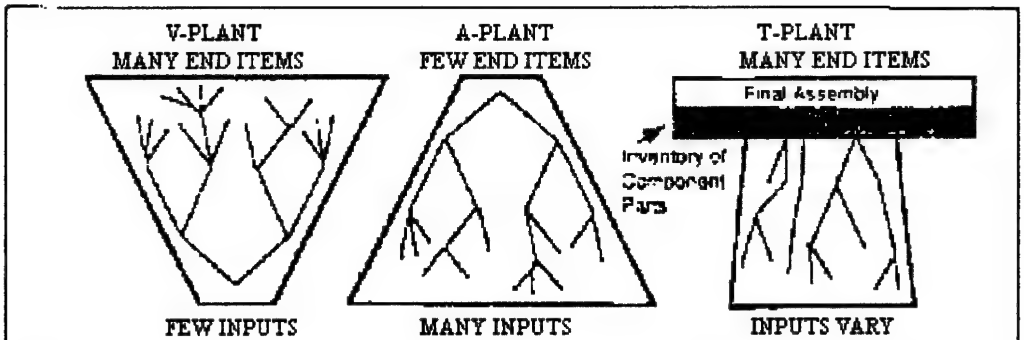
Potentially the most important conclusion that can be drawn from this study is the wisdom inherent in Step 5 of the TOC methodology. To survive and grow, the Army must become a learning organization constantly striving to improve itself. It must embed in its culture an attitude and mindset of "continual improvement". Only in this way can the organization stay ahead of its competitors and ensure its long term viability. Although the Army probably does not have to fear for its existence, it does need to be concerned about its relevance. As the world changes, so must the Army, lest it become obsolete.

APPENDIX A

FIGURES AND CHARTS

Figure 1-1. Examples of Contingencies Involving the Deployment of U.S. Forces

Name/Location	Dates	Type	CINC AOR
UNTAG	4/89 - 3/90	Treaty Supervision	EUCOM
Just Cause - Panama	10/89 - 1/90	Foreign Internal Defense	SOUTHCOM
Sharp Edge - Liberia	5/90 - 9/90	NEO	EUCOM
Desert Shield/Desert Storm	8/90 - 3/91	Repel Aggression - UNSCR 661	CENTCOM
Eastern Exit	1/91	NEO	CENTCOM
JTF Provide Comfort - Turkey	3/91 - Present	Humanitarian Relief - UNSCR 688	EUCOM
Sea Angel - Bangladesh	5/91 - 6/91	Disaster Relief	PACOM
Various - Caribbean/ GTMO	10/91 - 7/93	Refugee Support	ACOM
Provide Hope - CIS	2/92	Humanitarian Assistance	CJCS
Sierra Leone	5/92	NEO	EUCOM
Provide Promise - Balkans	7/92 - 12/95	Humanitarian Assistance UNSCR 743	EUCOM
Southern Watch - SWA/Iraq	8/92 - Present	Enforce UNSCR 687	CENTCOM
Typhoon Omar - Guam	8/92 - 9/92	Disaster Relief	PACOM
Restore Hope - Somalia	12/92 - 5/93	Peace Enforcement - UNSCR 751	CENTCOM
Provide Refuge - Marshall Islands	1/93	Disaster Relief	PACOM
Deny Flight - Balkans	4/93 - 8/95	Enforce UNSCR 816	EUCOM
Sharp Guard - Balkans	6/93 - 6/96	Enforce UNSCR 820	EUCOM
Able Sentry - Macedonia	7/93 - Present	Enforce UNSCR 795	EUCOM
Restore Democracy - Haiti	9/94 - 4/96	Peace Supervision - UNSCR 940	ACOM
Safe Haven/Distant Heaven	9/94 - 3/95	Refugee Support	SOUTHCOM
Vigilant Warrior	10/94	Deter Aggression	CENTCOM
Joint Endeavor - Balkans	12/95 - Present	Peace Implementation - UNSCR 1035	EUCOM

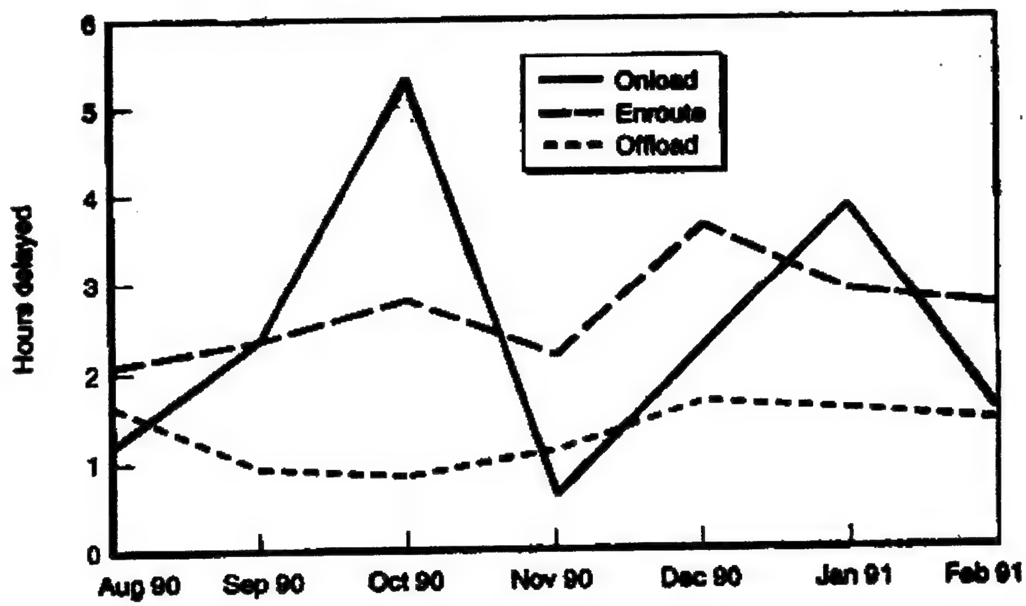


Principle Characteristic:	Divergence	Convergence	Manufacture-to-Forecast Assemble-to-Order
Number of Constraints:	Often only one	Several	Varies by Plant (0-several)
Placement of Buffers:	Constraint resources, and shipping	Constraint resources, assembly, and shipping	Constraint Resources, assembly, and shipping

Figure 2-1: Alternative Plant Configurations

- A-Plant - characterized by a large number of raw materials or component parts that are transformed into a small number of end items.
- V-Plant - typically produces many end items from a relatively small number of raw materials or component parts.
- T-Plant - characterized by a large number of raw materials transformed into a large number of end items.

Figure 3-1. Delays For Strategic Airlift.



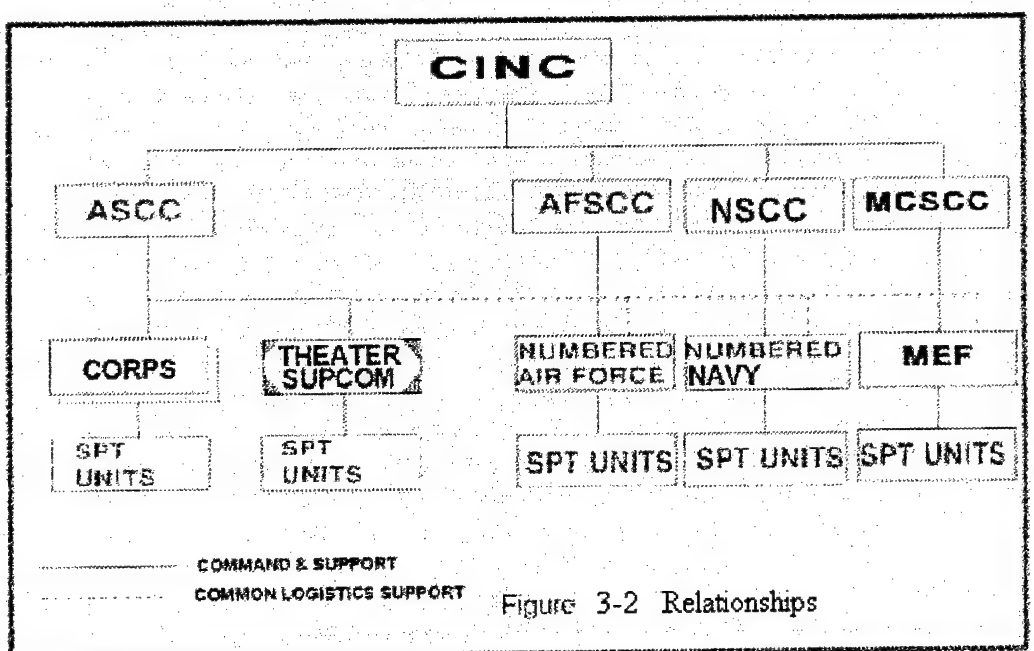


Figure 3-2 Relationships

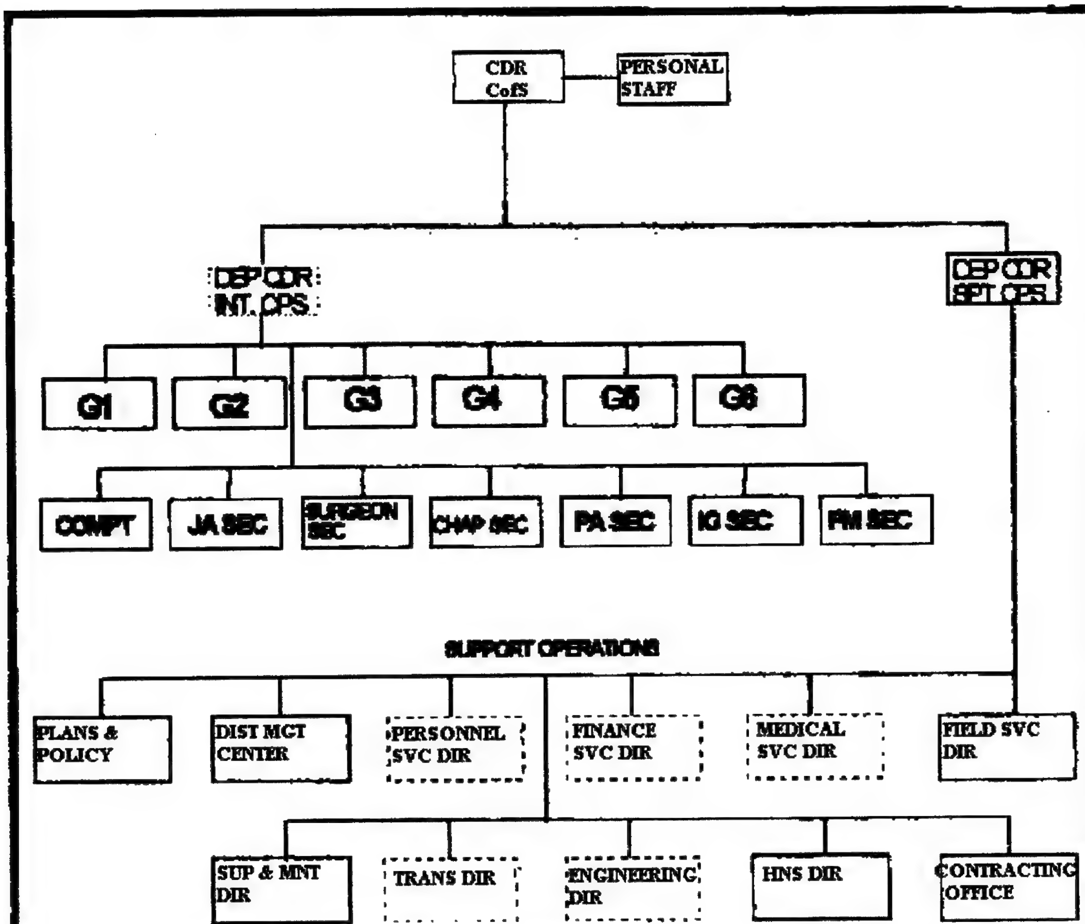


Figure 3-3. Theater Support Command (TSC)

Figure 3-1: Velocity Managment Statistics For Jun-Jul 97.

All Priorities: OST For FORSCOM Class IX, No Backorders

Location	Jun-Aug 97	Baseline
Bragg	8.5	26.5
Campbell	7.9	20.4
Stewart	9.3	22.4
Polk	11.7	24.2
Drum	5.6	23
Hood	10.8	23.7
Lewis	11.1	26.8
Carson	11.5	20.8
Riley	12.8	18.4
Irwin	13.4	22.3

All Priorities: Overall OST For Class IX, No Backorders

Location	Jun-Aug 97	Baseline
CONUS Active	12.1	22.4
OCONUS	21.9	33.7
CONUS	17.3	33.4

All Priorities: OST For OCONUS MACOMs Class IX, No Backorders

Location	Jun-Aug 97	Baseline
USAREUR	21	30.3
USARSO	19.1	37.6
EUSA(Korea)	24.7	34.5
USARPAC	19.3	35.9
Other	25.2	48.4

**All statistics were extracted from the Velocity Management Section of the CASCOM Homepage: www.cascom.army.mil

APPENDIX B

JFAST SIMULATION DATA

1. **POEs AND PODs**.

SPOE	APOE
• Savannah Beaumont	Syracuse
• Corpus Christi	Peterson
	Fort Hood

SPOD	APOD
• Manila	Manila
• Subic	Clark

2. **Simulation Settings.**

Air Scheduler	On	Use port permissions	Yes
		Use port throughput	Yes
Stop scheduling on CDay	C100	Use bulk, over, out from:	Level 2
ALD's determined by:	Model		

Land Scheduler	On
Use Origin Outloading:	Yes

Sea Scheduler — On

Stop scheduling on CDay	C180
Peace / War rules	Peace
Schedule Dry/POL/Both	Both
ALDs determined by:	Model
Desired load for ship	80 %
Minimum load for ship	50 %
Maximum allowed lateness	20 days
Containerization	TPFDD
Avg. AFOE delay	0 days
Avg. days to sheath a ship	0.4 days
Avg. days to dock a ship	0.2 days
Use policy shipping	No

Use port dimensions	Yes
Use port throughput	Yes
Korean ships restricted	No
NATO ships restricted	No
Maximum early delivery days	20 days
Mix Ammo/Non-Ammo	Yes

Fleet Delays	Use	Early Warn	Use	Admin Delay
MSC	☒	8	☒	8
US Commercial	☒	4	☒	4
RRF	☒	8	☒	8
NDRF	☒	4	☒	4
Effective US Control	☒	4	☒	4
NATO	☒	0	☒	0
Readiness Program	☒	4	☒	4
Korean Fleet	☒	0	☒	0

Canal Status and Characteristics

Canal Availability		Panama	Suez
Plan Start	C000	Open	Open
1st Change	C999	Open	Open
2nd Change	C999	Open	Open
3rd Change	C999	Open	Open
4th Change	C999	Open	Open
Ship Maximums		**Panama**	**Suez**
Length		950	5,000
Beam		106	210
Draft		39	41
Ship Flow Control		**Panama**	**Suez**
Minutes of separation		15	15
Days to transit		1.0	1.0

3. Ship Data.

use	nisc	name		fleetdesc	typedesc
_	M29963	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M28328	RO/RO	(Fast)	RRF-05	RO/RO
_	M38082	FSS	(Fast)	MSC FLEET	FSS
_	M38590	FSS	(Fast)	MSC FLEET	FSS
_	M57251	RO/RO	(SLOW)	MSC FLEET	RO/RO
_	M58580	RO/RO	(SLOW)	MSC FLEET	RO/RO
_	M36982	FSS	(Fast)	MSC FLEET	FSS
_	M52638	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M37793	FSS	(Fast)	MSC FLEET	FSS
_	M56909	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M46646	Tank-SDrft	(SLOW)	MSC FLEET	Tank-SDrft
_	M27604	Breakbulk	(SLOW)	RRF-05	Breakbulk
_	M27125	Breakbulk	(SLOW)	RRF-05	Breakbulk
_	M26922	Breakbulk	(SLOW)	RRF-05	Breakbulk
_	M38604	RO/RO: (SqFt)	(Fast)	RRF-05	RO/RO
_	M37001	RO/RO	(Fast)	RRF-05	RO/RO
_	M37694	RO/RO	(Fast)	RRF-05	RO/RO
_	M37760	RO/RO: (SqFt)	(Fast)	RRF-05	RO/RO
_	M37036	RO/RO	(Fast)	RRF-05	RO/RO
_	M32938	RO/RO	(SLOW)	RRF-05	RO/RO
_	M53113	RO/RO: (SqFt)	(Fast)	RRF-05	RO/RO
_	M46061	RO/RO	(Fast)	RRF-05	RO/RO
_	M46062	RO/RO	(Fast)	RRF-05	RO/RO
_	M46063	RO/RO	(Fast)	RRF-05	RO/RO
_	M21451	Breakbulk	(Fast)	RRF-05	Breakbulk
_	M22392	Breakbulk	(Fast)	RRF-05	Breakbulk
_	M38394	RO/RO	(SLOW)	RRF-05	RO/RO
_	M36817	RO/RO	(SLOW)	RRF-05	RO/RO
_	M36593	Seabee	(SLOW)	RRF-05	Seabee
_	M36726	Seabee	(SLOW)	RRF-05	Seabee
_	M57330	RO/RO	(SLOW)	RRF-05	RO/RO
_	M47409	RO/RO	(SLOW)	RRF-05	RO/RO
_	M47037	RO/RO	(SLOW)	RRF-05	RO/RO
_	M36983	FSS	(Fast)	MSC FLEET	FSS
_	M03924	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M29665	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M41878	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M40329	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M46082	Tank-Large	(SLOW)	SEA-RDYPGM	Tank-Large
_	M19452	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M04250	RO/RO	(SLOW)	RRF-05	RO/RO
_	M38873	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M46116	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M38853	FSS	(Fast)	MSC FLEET	FSS
_	M36637	Container NSS	(Fast)	SEA-	Ctnr-NSS

				RDYPGM	
_	M37855	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M00244	RO/RO	(SLOW)	SEA-RDYPGM	RO/RO
_	M57350	TugBrg-Lqd	(SLOW)	SEA-RDYPGM	TugBrg-Lqd
_	M05082	Tanker - Medium	(Slow)	SEA-RDYPGM	Tank-Med
_	M32023	Tank-Large	(SLOW)	SEA-RDYPGM	Tank-Large
_	M52739	Breakbulk	(SLOW)	MSC FLEET	Breakbulk
_	M40843	Lash	(Fast)	SEA-RDYPGM	Lash
_	M54850	Breakbulk	(SLOW)	MSC FLEET	Breakbulk
_	M64495	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M37782	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M38852	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M32003	Lash	(Slow)	MSC FLEET	Lash
_	M57235	TugBrg-Lqd	(SLOW)	SEA-RDYPGM	TugBrg-Lqd
_	M46085	Tank-Large	(SLOW)	SEA-RDYPGM	Tank-Large
_	M29583	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M04782	RO/RO	(SLOW)	SEA-RDYPGM	RO/RO
_	M28595	RO/RO	(Fast)	RRF-05	RO/RO
_	M46094	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M46092	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M46093	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M46113	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M64258	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M57709	Tank-HSize	(SLOW)	MSC FLEET	Tank-HSize
_	M38591	FSS	(Fast)	MSC FLEET	FSS
_	M35121	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M35429	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M33964	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M37720	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M60972	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M35880	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M60277	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M46114	Tank-Med	(SLOW)	SEA-RDYPGM	Tank-Med
_	M37792	FSS	(Fast)	MSC FLEET	FSS
_	M54771	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M40305	Lash	(Fast)	SEA-	Lash

				RDYPGM	
_	M46115	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M40547	Lash	(Fast)	SEA-RDYPGM	Lash
_	M64846	Tank-Med	(SLOW)	MSC FLEET	Tank-Med
_	M29923	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M28726	Container NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M40304	Lash	(Fast)	SEA-RDYPGM	Lash
_	M44477	RO/RO	(SLOW)	MSC FLEET	RO/RO
_	M38972	Ctnr-NSS	(Fast)	SEA-RDYPGM	Ctnr-NSS
_	M00010	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M64888	Ctnr-NSS	(SLOW)	SEA-RDYPGM	Ctnr-NSS
_	M39361	Tank-Large	(SLOW)	SEA-RDYPGM	Tank-Large
_	M38708	Tank-Small	(SLOW)	MSC FLEET	Tank-Small

4. **Airlift Apportionment.**

MOB Code: SO Air Mean Distance = 7606 NM

Type		Period 1	Period 2	Period 3	Period 4
C141B	Number	5/12	14/20	60/10	
	UTE Rate	00/12	13/11	46/10	
C5	Number	5/6	14/10	60/5	
	UTE Rate	00/10	3/9	16/10	46/10
LRWC	Number	7/4	14/8	60/15	
	UTE Rate	1/10			
LRWP	Number	7/15	14/30	60/15	
	UTE Rate	1/10			

5. **Unit Data.**

supplyclas	unitname	pax	orig	origname	poe	poename	pod	podname	dest	destname	lad	airclos	airlates	seaclos	sealate	ald	qualified	qctrl	source
	AVN MAINT CO LID UH PURE	146	ESGM	Ft Drum	YTPM	Westover Afb-metr	PAXH	Manila Internatio	WRYV		C010		N/A		N/A	C005	Yes	Ok	PAX Only

INF BN LIGHT	5 6 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
TRANS LIGHT MDM TRUCK CO	1 0 8	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
DIV SIG BN MSE LID	4 5 8	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
MAINT CO NON DIVISIONAL D	1 9 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
INF BN LIGHT	5 6 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHC LIGHT INFANTRY DIV	2 7 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
DIVISION ARMY BAND DS	4 1	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ENGR BN INF DIV LT	4 1 5	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
FA BN 105MM T LT INF DIV	4 1 7	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
PUBLIC AFFAIRS TEAM	5	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ATTACK BATTALION OH 58D	2 3 0	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	DV LK	Clark Air Base	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	Fl a w	PAX Only
ENGR CBT BN CORPS	7 8 4	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
CHEMICAL COMPANY DECON	1 3 1	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
AREA SIG FE BN MSE ABN	6 9 7	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
CHEMICAL COMPANY DECON	1 3 1	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
MP CO COMBAT SUPPORT	1 8 2	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHC SUPPORT GROUP CORPS	1 1 0	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
MP CO COMBAT SUPPORT	1 8 2	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only

MP CO COMBAT SUPPORT	1 8 2	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ENGR CO MDM GIRDER BRIDG	1 1 0	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ENGR CBT SPT EQUIP CO	1 7 8	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ENGR CO ASLT FLTBRG RIB	1 8 2	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
MAIN SPT BN LID	5 2 2	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHD MP BATTALION	6 5	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHC DIV AVN BDE IDL	1 5 3	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
CHEMICAL CO SMK DECON	1 4 0	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
TRANS LIGHT MDM TRUCK CO	1 0 8	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
PER SVC COMPANY TYPE C	1 3 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
INF BN LIGHT	5 6 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
INF BN LIGHT	5 6 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHD CHEMICAL BATTALION	4 3	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
CAVALRY SQDN INF DIV LT	2 7 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	DV LK	Clark Air Base	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	Fl a w	PAX Only
INF BN LIGHT	5 6 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
FA BN 105MM T LT INF DIV	4 1 7	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHD CORPS SUPPORT BN	5 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
INF BN LIGHT	5 6 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only

FA BTRY 155MM T LT INF DI	1 4 4	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHC MMC SPT CMD INF DIV L	1 4 0	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
MI BN INF DIV LT	4 6 1	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ADA BN LT INF DIV	3 0 5	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ASSAULT BN UH 60	3 4 4	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHC INF DIV BDE LID	7 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHB DIV ARTY LT INF DIV	1 3 3	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
FWD SPT BN LID	1 9 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
FWD SPT BN LID	1 9 9	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
HHC INF DIV BDE LID	7 6	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
MP COMPANY LIGHT INF DIV	9 0	ES G M	Ft Dru m	YT P M	Westove r Afb- metr	PA XH	Manila Internati o	W RY V	C 01 0	N/ A	N/ A	C 00 5	Ye s	O k	PAX Only
ARMD CAV TRP HSB	1 5 5	HD DL	Ft Cars on	TD H V	C Springs- petersn	PA XH	Manila Internati o	W RY V	C 01 5	N/ A	N/ A	C 00 2	Ye s	O k	TUC HA
(1C) MOVEMENT CONTROL	4	HC TL	Ft Brag g	T M K H	Pope Afb	DV LK	Clark Air Base	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) WATER PURIF DETACHMENT	5 0	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) MOVEMENT CON AIR TERM	3 7	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) MOVEMENT CONTROL	8	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) MOVEMENT CONTROL	5	HC TL	Ft Brag	T M	Pope Afb	PA XH	Manila Internati	W RY	C 02	N/	N/	C 01	Ye s	O k	PAX Only

			g	KH			o	V	0	A	A	0			
(1C) TRAILER TRANSFER POINT OP	16	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MOVEMENT CONTROL	5	HC TL	Ft Bragg	TMKH	Pope Afb	DV LK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) QM WTR PURIF TM 12000GPH	15	HC TL	Ft Bragg	TMKH	Pope Afb	DV LK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) TRANS CARGO TRANSFER CO	238	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) TRANS MOV CON CTR COSCOM	43	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MOVEMENT CONTROL	7	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MOVEMENT CONTROL	8	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MED DET PM ENTOMOLOGY	11	HC TL	Ft Bragg	TMKH	Pope Afb	DV LK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) DIR SPT POSTAL COMPANY	63	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) EOD DETACHMENT	23	HC TL	Ft Bragg	TMKH	Pope Afb	DV LK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) EOD CONTROL TEAM	12	HC TL	Ft Bragg	TMKH	Pope Afb	DV LK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1T) AUTOMATED CARGO DOC	27	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) CARGO DOCUMENTATION	8	HC TL	Ft Bragg	TMKH	Pope Afb	PA XH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only

(1C) MED DET PM SANITATION	11	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1T) MP GUARD CO	124	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) AIR AMBULANCE UH 1	54	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MED LOG SUPPORT DET	39	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MED BN AREA SUPPORT	343	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) HHD TRANS MOTOR TRANS BN	47	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MED DET VET SVC	48	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) DIR SPT POSTAL COMPANY	101	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) HHD MED EVAC BN	46	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MIB CEWI ABN CORPS GRV	318	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) TAC WTR DISTR HOSELINE	20	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) HHC MEDIUM HELICOPTER BN	62	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) AVN MAINT CO XVIII CORPS	323	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) MEDIUM HEL CO CH 47	20	HCTL	Ft Brag	TM	Pope Afb	PAXH	Manila Internati	WRY	C02	N/	N/	C01	Yes	Fla	PAX Only

	2		g	K H			o	V	0	A	A	0		w	
(1C) MEDIUM HEL CO CH 47	2 0 2	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	Fl a w	PAX Only
(1C) HHC AVIATION BDE CORPS	7 7	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) ATTACK HEL BN AH 64	2 6 5	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	Fl a w	PAX Only
(1C) HHB FA BDE WITH TACFIRE	1 3 4	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) 00MOBILE PUBLIC AFF DET	1 8	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) MAINT CO DS PATRIOT ADSCO	1 2 7	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) CORPS TGT ACQ DETACHMENT	3 9	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) AIR RECON SQUADRON OH 58D	3 7 2	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	Fl a w	PAX Only
(1C) COMMAND AVN BN CORPS	3 5 3	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) FA BATTALION MLRS	4 3 2	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) HHB ADA BRIGADE HVY CORPS	1 6 9	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) TACT EXPL BN AC MI BDE AB	5 9 0	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only
(1C) OPS BN MI BDE ABN	3 8 0	HC TL	Ft Brag g	T M K H	Pope Afb	PA XH	Manila Internati o	W RY V	C 02 0	N/ A	N/ A	C 01 0	Ye s	O k	PAX Only

(1C) NBC RECON CO	140	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) CML SERVICE ORGANIZATION	5	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) HQ HQ DET MI BDE ABN CORP	65	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) TRANS HEAVY TRUCK COMPANY	153	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) HHC MP BRIGADE	98	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) HHC ENGR BDE CORPS	127	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) ADA BN PATRIOT	727	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) TERRAIN DIR SPT ELEMENT	3	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) PLATOON HQS	3	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) T MDM TRK CO 5000 GAL TAN	174	HCTL	Ft Bragg	TMKH	Pope Afb	DVLK	Clark Air Base	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
(1C) TERRAIN ANALYSIS SQUAD	6	HCTL	Ft Bragg	TMKH	Pope Afb	PAXH	Manila Internatio	WRYV	C020	N/A	N/A	C010	Yes	Ok	PAX Only
ENGR CBT SPT EQUIP CO	0	ESGM	Ft Drum	AZTG	Bayonne	PAXM	Manila	WRYV	C022	N/A	N/A	C005	Yes	Ok	TUCHA
ENGR CO ASLT FLTBRG RIB	0	ESGM	Ft Drum	AZTG	Bayonne	PAXM	Manila	WRYV	C022	N/A	N/A	C005	Yes	Ok	TUCHA
MAIN SPT BN LID	0	ESGM	Ft Drum	AZTG	Bayonne	PAXM	Manila	WRYV	C022	N/A	N/A	C005	Yes	Ok	TUCHA
HHD MP	0	ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC

BATTALION	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
HHC DIV AVN BDE	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
IDL	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
CHEMICAL CO	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
SMK DECON	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
TRANS LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
MDM TRUCK CO	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
PER SVC	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
COMPANY TYPE C	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
INF BN LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
INF BN LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
AVN MAINT CO	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
LID UH PURE	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
INF BN LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
TRANS LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
MDM TRUCK CO	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
DIV SIG BN MSE	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
LID	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
MAINT CO NON	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
DIVISIONAL D	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
INF BN LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
HHC LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
INFANTRY DIV	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
DIVISION ARMY	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
BAND DS	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
ENGR BN INF DIV	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
LT	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
FA BN 105MM T LT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
INF DIV	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
PUBLIC AFFAIRS	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
TEAM	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
ATTACK	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC

BATTALION OH	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
58D	M	m	G	M	V	2	A	A	5		
ENGR CBT BN	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
CORPS	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
CHEMICAL	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
COMPANY	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
DECON	M	m	G	M	V	2	A	A	5		
AREA SIG FE BN	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
MSE ABN	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
CHEMICAL	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
COMPANY	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
DECON	M	m	G	M	V	2	A	A	5		
MP CO COMBAT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
SUPPORT	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
HHC SUPPORT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
GROUP CORPS	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
MP CO COMBAT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
SUPPORT	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
MP CO COMBAT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
SUPPORT	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
ENGR CO MDM	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
GIRDER BRIDG	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
HHD CHEMICAL	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
BATTALION	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
CAVALRY SQDN	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
INF DIV LT	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
INF BN LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
FA BN 105MM T LT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
INF DIV	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
HHD CORPS	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
SUPPORT BN	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
INF BN LIGHT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
FA BTRY 155MM T	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
LT INF DI	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
HHC MMC SPT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC
CMD INF DIV L	G	Dru	T	X	RY	02	N/	N/	00 s	k	HA
	M	m	G	M	V	2	A	A	5		
MI BN INF DIV LT	0 ES	Ft	AZ Bayonne	PA Manila	W	C			C Ye	O	TUC

	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
ADA BN LT INF	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
DIV	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
ASSAULT BN UH	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
60	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
HHC INF DIV BDE	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
LID	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
HHB DIV ARTY LT	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
INF DIV	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
FWD SPT BN LID	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
FWD SPT BN LID	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
HHC INF DIV BDE	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
LID	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
MP COMPANY	0 ES	Ft	AZ	Bayonne	PA	Manila	W	C			C	Ye	O	TUC
LIGHT INF DIV	G	Dru	T		X		RY	02	N/	N/	00	s	k	HA
	M	m	G		M		V	2	A	A	5			
(1C) MED LOG	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
SUPPORT DET	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) MED BN	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
AREA SUPPORT	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) HHD TRANS	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
MOTOR TRANS BN	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) MED DET	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
VET SVC	TL	Brag	ES	on	X		RY	03	N/	N/	01	s	k	HA
		g			M		V	1	A	A	0			
(1C) DIR SPT	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
POSTAL	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
COMPANY		g			V	Ba	V	1	A	A	0			
(1C) HHD MED	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
EVAC BN	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) MIB CEWI	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
ABN CORPS GRV	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) TAC WTR	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
DISTR HOSELINE	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) HHC MEDIUM	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
HELICOPTER BN	TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g			V	Ba	V	1	A	A	0			
(1C) AVN MAINT	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC

CO XVIII CORPS	TL	Brag	ES on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g		V	Ba	V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CONTROL	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) WATER	0 HC	Ft	ZB Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
PURIF	TL	Brag	ES on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
DETACHMENT		g		V	Ba	V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CON AIR TERM	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CONTROL	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CONTROL	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) TRAILER	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
TRANSFER POINT	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
OP		g		M		V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CONTROL	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) QM WTR	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
PURIF TM	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
12000GPH		g		M		V	1	A	A	0			
(1C) TRANS	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CARGO	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
TRANSFER CO		g		M		V	1	A	A	0			
(1C) TRANS MOV	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CON CTR	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
COSCOM		g		M		V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CONTROL	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) MOVEMENT	0 HC	Ft	ZB Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
CONTROL	TL	Brag	ES on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g		V	Ba	V	1	A	A	0			
(1C) MED DET PM	0 HC	Ft	ZB Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
ENTOMOLOGY	TL	Brag	ES on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
		g		V	Ba	V	1	A	A	0			
(1C) DIR SPT	0 HC	Ft	ZB Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
POSTAL	TL	Brag	ES on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
COMPANY		g		V	Ba	V	1	A	A	0			
(1C) EOD	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
DETACHMENT	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) EOD	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CONTROL TEAM	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1T) AUTOMATED	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CARGO DOC	TL	Brag	ES on	X		RY	03	N/	N/	01	s	k	HA
		g		M		V	1	A	A	0			
(1C) CARGO	0 HC	Ft	ZB Wilmingt	PA	Manila	W	C			C	Ye	O	TUC

DOCUMENTATION	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) MED DET PM	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
SANITATION	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1T) MP GUARD	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CO	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) AIR	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
AMBULANCE UH 1	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) TERRAIN DIR	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
SPT ELEMENT	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) PLATOON	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
HQS	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) T MDM TRK	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CO 5000 GAL TAN	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) TERRAIN	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
ANALYSIS SQUAD	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) MEDIUM HEL	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CO CH 47	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) MEDIUM HEL	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
CO CH 47	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) HHC	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
AVIATION BDE	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
CORPS		g			M		V	1	A	A	0			
(1C) ATTACK HEL	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
BN AH 64	TL	Brag	ES on		KL	o-subic	RY	03	N/	N/	01 s		k	HA
		g			V	Ba	V	1	A	A	0			
(1C) HHB FA BDE	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
WITH TACFIRE	TL	Brag	ES on		KL	o-subic	RY	03	N/	N/	01 s		k	HA
		g			V	Ba	V	1	A	A	0			
(1C) 00MOBILE	0 HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
PUBLIC AFF DET	TL	Brag	ES on		X		RY	03	N/	N/	01 s		k	HA
		g			M		V	1	A	A	0			
(1C) MAINT CO DS	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
PATRIOT ADSCO	TL	Brag	ES on		KL	o-subic	RY	03	N/	N/	01 s		k	HA
		g			V	Ba	V	1	A	A	0			
(1C) CORPS TGT	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
ACQ	TL	Brag	ES on		KL	o-subic	RY	03	N/	N/	01 s		k	HA
DETACHMENT		g			V	Ba	V	1	A	A	0			
(1C) AIR RECON	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
SQUADRON OH	TL	Brag	ES on		KL	o-subic	RY	03	N/	N/	01 s		k	HA
58D		g			V	Ba	V	1	A	A	0			
(1C) COMMAND	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
AVN BN CORPS	TL	Brag	ES on		KL	o-subic	RY	03	N/	N/	01 s		k	HA
		g			V	Ba	V	1	A	A	0			
(1C) FA	0 HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC

BATTALION MLRS		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
			g			V	Ba	V	1	A	A	0			
(1C) HHB ADA	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
BRIGADE HVY		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
CORPS			g			V	Ba	V	1	A	A	0			
(1C) TACT EXPL	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
BN AC MI BDE AB		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
			g			V	Ba	V	1	A	A	0			
(1C) OPS BN MI	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
BDE ABN		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
			g			V	Ba	V	1	A	A	0			
(1C) NBC RECON	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
CO		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
			g			V	Ba	V	1	A	A	0			
(1C) CML SERVICE	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
ORGANIZATION		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
			g			V	Ba	V	1	A	A	0			
(1C) HQ HQ DET	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
MI BDE ABN CORP		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
			g			V	Ba	V	1	A	A	0			
(1C) TRANS	0	HC	Ft	ZB	Wilmingt	W	Olongap	W	C			C	Ye	O	TUC
HEAVY TRUCK		TL	Brag	ES	on	KL	o-subic	RY	03	N/	N/	01	s	k	HA
COMPANY			g			V	Ba	V	1	A	A	0			
(1C) HHC MP	0	HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
BRIGADE		TL	Brag	ES	on	X		RY	03	N/	N/	01	s	k	HA
			g			M		V	1	A	A	0			
(1C) HHC ENGR	0	HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
BDE CORPS		TL	Brag	ES	on	X		RY	03	N/	N/	01	s	k	HA
			g			M		V	1	A	A	0			
(1C) ADA BN	0	HC	Ft	ZB	Wilmingt	PA	Manila	W	C			C	Ye	O	TUC
PATRIOT		TL	Brag	ES	on	X		RY	03	N/	N/	01	s	k	HA
			g			M		V	1	A	A	0			
ENGR CO MDM	1	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
GIRDER BRIDG	1	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	0		on	V	petersn		o	V	5	A	A	8			
UTILITIES 4000	5	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
TEAM	4	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
			on	V	petersn		o	V	5	A	A	8			
ENGR BN HVY	4	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
DIV	4	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	1		on	V	petersn		o	V	5	A	A	8			
PUBLIC AFFAIRS	5	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
TEAM		DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
			on	V	petersn		o	V	5	A	A	8			
HHC INF DIV	9	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
MECH BDE	1	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
			on	V	petersn		o	V	5	A	A	8			
FA BN 155 SP HVY	7	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
DIV 3X8	3	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	1		on	V	petersn		o	V	5	A	A	8			
TANK BATTALION	5	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
HVY DIV	5	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	8		on	V	petersn		o	V	5	A	A	8			
INF BN MECH	8	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX

	1	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	6		on	V	petersn		o	V	5	A	A	8			
MP CO HVY DIV	1	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
	6	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	0		on	V	petersn		o	V	5	A	A	8			
INF BN MECH	8	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
	1	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	6		on	V	petersn		o	V	5	A	A	8			
TANK BATTALION	5	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
HVY DIV	5	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	8		on	V	petersn		o	V	5	A	A	8			
FWD SPT BN 1X2	4	HD	Ft	TD	C	PA	Manila	W	C			C	Ye	O	PAX
HVY DIV	2	DL	Cars	H	Springs-	XH	Internati	RY	03	N/	N/	00	s	k	Only
	9		on	V	petersn		o	V	5	A	A	8			
ENGR CO MDM	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
GIRDER BRIDG		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
UTILITIES 4000	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
TEAM		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
ENGR BN HVY	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
DIV		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
PUBLIC AFFAIRS	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
TEAM		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
HHC INF DIV	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
MECH BDE		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
FA BN 155 SP HVY	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
DIV 3X8		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
TANK BATTALION	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
HVY DIV		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
INF BN MECH	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
MP CO HVY DIV	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											
INF BN MECH	0	HD	Ft	F	Diego	PA	Manila	W	C			C	Ye	O	TUC
		DL	Cars	G	Garcia	X		RY	03	N/	N/	00	s	k	HA
			on	D		M		V	5	A	A	8			
				D											

TANK BATTALION HVY DIV	0 HD DL	Ft Cars on	F G D D	Diego Garcia	PA X M	Manila	W RY V	C 03 5	N/ A	N/ A	C 00 8	Ye s	O k	TUC HA
FWD SPT BN 1X2 HVY DIV	0 HD DL	Ft Cars on	F G D D	Diego Garcia	PA X M	Manila	W RY V	C 03 5	N/ A	N/ A	C 00 8	Ye s	O k	TUC HA

ENDNOTES

[1] This table was extracted from a recent study conducted by the Institute for Defense Analysis. "Doctrine, Organization, and Systems for Reception, Staging, Onward Movement, and Integration (RSOI) Operations", January 1997, pg 2.

[2] Distribution-based logistics is a concept which exploits expected improvements in information technologies to allow distribution agility on the battlefield and logistics velocity instead of the historical logistics mass concept (large inventories throughout the battlefield). The Army logistics community is currently somewhere between the two concepts as it continues to improve its automated logistics control systems. For a more complete discussion on distribution-based logistics see "Preparing For The Revolution In Military Logistics: The Way Ahead", found on the CASCOM Homepage. Vision 2010 refers to this evolving logistics system as well: "Focused logistics will be the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while enroute, and to deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical levels of operations."

[3] Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, 23 March 1994, pg 419.

[4] Institute for Defense Analysis. "Doctrine, Organization, and Systems for Reception, Staging, Onward Movement, and Integration (RSOI) Operations", January 1997, pg II-14.

[5] Ibid., pg II-20.

[6] Ibid., pg II-20.

[7] Ibid., pgs. II-21 to II-27. These pages give a detailed definition for each of these holding areas, processing areas, transfer points, and support sites. This reference addresses all of them. Otherwise the reader must go to six different field manuals to gather the same information.

[8] Chapter 2 of this study explains what TOC is and how it can be used to analyze force deployment operations. For a detailed discussion of TOC see Eliyahu M. Goldratt's "The Goal: A Process of Ongoing Improvement", New River Press, 1992.

[9] Fawcett, Stanley E. and John N. Pearson, "Understanding and Applying Constraint Management In Today's Manufacturing Environments", Production and Inventory Management Journal, v. 32 (3), pg. 54.

[10] Goldratt, Eliyahu M., What Is This Thing Called Theory Of Constraints And How Should It Be Implemented?, New York: North River Press, Inc., 1990, pg10.

[11] This is the author's characterization of the manufacturing process based on his experience of working in several types of manufacturing plants.

[12] The funnel analogy was first used by Stanley E Fawcett and John N. Pearson (see endnote 12).

[13] Fawcett, Stanley E. and John N. Pearson, "Understanding and Applying Constraint Management In Today's Manufacturing Environments", Production and Inventory Management Journal, v. 32 (3), pps.46-55, 1991.

[14] Goldratt, Eliyahu M. and Jeff Cox, The Goal: A Process of Ongoing Improvement, (Second Revised Edition) New York: North River Press, Inc., 1992, pgs 5&6.

[15] Richard B. Chase and Nicholas J. Aquilano discuss the data collection method in their book Production and Operations Management: A Life Cycle Approach (Fifth Edition), Boston: Irwin, 1989. Stanley E. Fawcett and John N. Pearson discuss the plant type method (see endnote 12). Goldratt and Cox (see endnote 13) discuss in detail the manual method for identifying the constraint.

[16] Chase, Richard B. and Nicholas J. Aquilano, Production and Operations Management: A Life Cycle Approach (Fifth Edition Boston: Irwin, 1989), pg 89.

[17] Fawcett, Stanley E. and John N. Pearson, "Understanding and Applying Constraint Management In Today's Manufacturing Environments", Production and Inventory Management Journal, v. 32 (3), pps.46-55, 1991.

[18] TQM Division, "How To Incorporate Effective Improvement", Navy Aviation Depot, Alameda, CA., September 1990.

[19] Goldratt, Eliyahu M. and Jeff Cox. The Goal. A Process of Ongoing Improvement. 2d Revised Ed New York: North River Press, Inc., 1992, pg 45.

[20] Trietsch, Dan, "Focused TQM and Synergy: A Case Study", Working Paper No. 92-06, September 1992. pg 14.

[21] Schragenheim, Eli and Boaz Ronen, "Drum-Buffer-Rope Shop Floor Control", Production Inventory Management Journel, v.32 (3), pp. 18-22 (Third Quarter, 1991), pg 18.

[22] Ibid., pg 21.

[23] Goldratt, Eliyahu M., What Is This Thing Called Theory Of Constraints And How Should It Be Implemented?, New York: North River Press, Inc., 1990, pg 27.

[24] For a more detailed discussion see F. C. "Ted" Weston's "Functional Goals Are Often In Conflict With Each Other", Industrial Engeneering, November 1991.

[25] Weston, F. C., "Functional Goals Are Often In Conflict With Each Other", Industrial Engeneering, November 1991, pg. 27.

[26] Dorner, Dietrich. The Logic Of Failure. Translated by Rita and Robert Kimber. New York: Metropolitan Books, Henry Holt and Company, 1996, pg.

[27] As noted earlier, not all assets enter the pipeline at the same origin. Forces designed to self deploy (like aviation units given the deployment distance is sufficiently short) and self contained forces (like the 82d Airborne Division which doesn't necessarily need an APOD or SPOD) can potentially bypass the system constraint. This is in effect a means of exploiting the constraint. It is a way to reduce the amount of assets that must run through it with the result of increasing system throughput.

[28] "Project AIR FORCE Analysis of the Air War in the Gulf: An Assessment of Strategic Airlift Operational Efficiency", Prepared for the U S Air Force by Rand (John Lund, Ruth Berg, Corinne Replogle), November 1994, pgs 24, 27, 28, 34, 42, 45.

[29] Ibid., pg 7.

[30] Ibid., pgs 35 & 36.

[31] Ibid., pg 44.

[32] Matthews, James K. and Cora J. Holt, "So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm", Joint History Office of the Chairman of the Joint Chiefs of Staff and Research Center United States Transportation Command, 1996, pg 183.

[33] Matthews, James K. and Cora J. Holt, "So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm", Joint History Office of the Chairman of the Joint Chiefs of Staff and Research Center United States Transportation Command, 1996, pg 11.

[34] Ibid., pg 11.

[35] Ibid., pg 139.

[36] Ibid., pg 120. It is important to note that even though this program was never implemented some ships under the program responded voluntarily and participated in the operation. Even given this, more ships were available for use. The conclusion one must draw is that strategic lift was not the limiting constraint for the system.

[37] "Transporting the Army for Operation Restore Hope", Rand Study prepared by David Kassing, November, 1994, pg xiv.

[38] Ibid., pg 39. Onward movement was fairly limited during this operation. Most of the U. S. military units set up within the Mogadishu area minimizing the onward movement requirement. It is clear from this study that the condition and capacity of the sea port and airfield impacted all operations occurring in support of the force flow.

[39] Ibid., pg xiii.

[40] Ibid., pg 33.

[41] Institute for Defense Analysis. "Doctrine, Organization, and Systems for Reception, Staging, Onward Movement, and Integration (RSOI) Operations", January 1997, pg IV-8.

[42] The simulation uses the port capacity as determined by site surveys accepted by USTRANSCOM. Port capacity is a function of the infrastructure at the facility. This includes the number of berths, cranes, warehousing space available etc. The model assumes the availability of adequately trained personnel to operate the equipment at the port.

[43] Given the proper tools, this analysis is worthy of further study. The results of such an analysis would provide planners and decision makers a means of prioritizing improvements designed to break the constraint.

[44] A change in any of these areas may cause a significant change in the way an institution operates. Conservative institutions, like the military, resist change both revolutionary (high risk with high return or loss) and evolutionary (lower risk with lower return or loss). If changes are perceived as revolutionary the institution will resist will all its will. If they are perceived as evolutionary, significant resistance will still result because of the conservative (risk averse) nature of the organization. Clausewitz's notion that 'even simple things in war are difficult' applies apply to the military institution as it attempts to implement significant change.

[45] Concept For Support Command and Control at Echelons Above Corps (Draft), US Army Combined Arms Support Command, Fort Lee, Virginia, 6 December 1996, pg 8.

[46] Ibid., pg 5.

[47] The TSC is designed so that depending on METT-T, self-contained portions of it can deploy to support operations in theater. The functional support modules include general engineering, finance, personnel support, medical, materiel management and maintenance, and transportation. Each module will be capable of providing EAC level management in its functional area. The headquarters of the TSC is also designed so that only that which is necessary to command and control the functional modules is deployed into the theater of operations. The concepts of split based operations and BD are discussed in some detail in the following section of the study.

[48] Concept For Support Command and Control at Echelons Above Corps (Draft), US Army Combined Arms Support Command, Fort Lee, Virginia, 6 December 1996, pg 7. For a more detailed discussion on the operations of the LSE see FM 63-11.

[49] For a more complete discussion of the functions of the LSE and LOGCAP see FM 63-11.

[50] Preparing for the Revolution in Military Logistics: The Way Ahead, CASCOM Homepage, www.cascom.mil/. These characterizations of the logistics system are commonly used throughout the Army in briefings, papers, and various articles.

[51] Thoma, Ann L.. "Determining the Requirement for a 'Separate Stovepipe' for Class VIII in a High-tech Environment". Graduate Paper, Florida Institute of Technology, 1994, pg4.

[52] The BD concept has also been championed by the Transportation Corps. It's emphasis on distribution dovetails nicely with the function of transportation. The BD concept has merit for the modern battlefield.

[53] "Battlefield Distribution Information Paper", CASCOM Homepage, www.cascom.army.mil/.

[54] TQM is a management philosophy which focuses on continual improvement in the system. It recognizes the importance and responsibility of all persons involved in the process to ensure quality throughout. It strives to get everyone involved in the quality process.

TOC is a management philosophy that uses the concept of a 'system constraint' to guide the manager in improving the process thereby maximizing system throughput. For additional information on TOC see The Goal, A Process of Ongoing Improvement, by Eliyahu M. Goldratt. Chapter 2 of this study discusses the key aspects of TOC and its application to this military problem.

[55] Velocity Management Training Support Package, CASCOM Homepage, www.cascom.army.mil/Multi/Training/tsp/Velocity_Mgt/Online_briefing/, pgs. 3-5.

[56] Ibid., pg 3.

[57] Ibid., pg 7.

[58] Ballou, Ronald H. Business Logistics Management. Third Edition. Prentice Hall: New Jersey, 1992, pg 289.

[59] A disconnect currently exists between the automated systems that provide visibility of stationary assets and those that control the movement of those assets. This disconnect should surprise no one. The separation of supply and transportation and a lack of understanding the interconnectedness of the two has led to the development of automated systems that do not communicate with each other. Branch self-interest and good intentions are the primary drivers for this disconnect. TAV should correct this deficiency.

[60] The author uses the term "inventory" in this statement in a broad sense. Inventory refers to supply, equipment and personnel.

[61] During ODS commercial airlines flying military personnel refused to land at airfields where there was a perceived threat. On more than one occasion, airflow had to be re-routed to more secure landing sites.

[62] Institute for Defense Analysis. "Doctrine, Organization, and Systems for Reception, Staging, Onward Movement, and Integration (RSOI) Operations", January 1997, pg III-7&8.

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